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GB 2114858 A EP 0280231 A2 EP 0168258 A2
EP 0152013 A2

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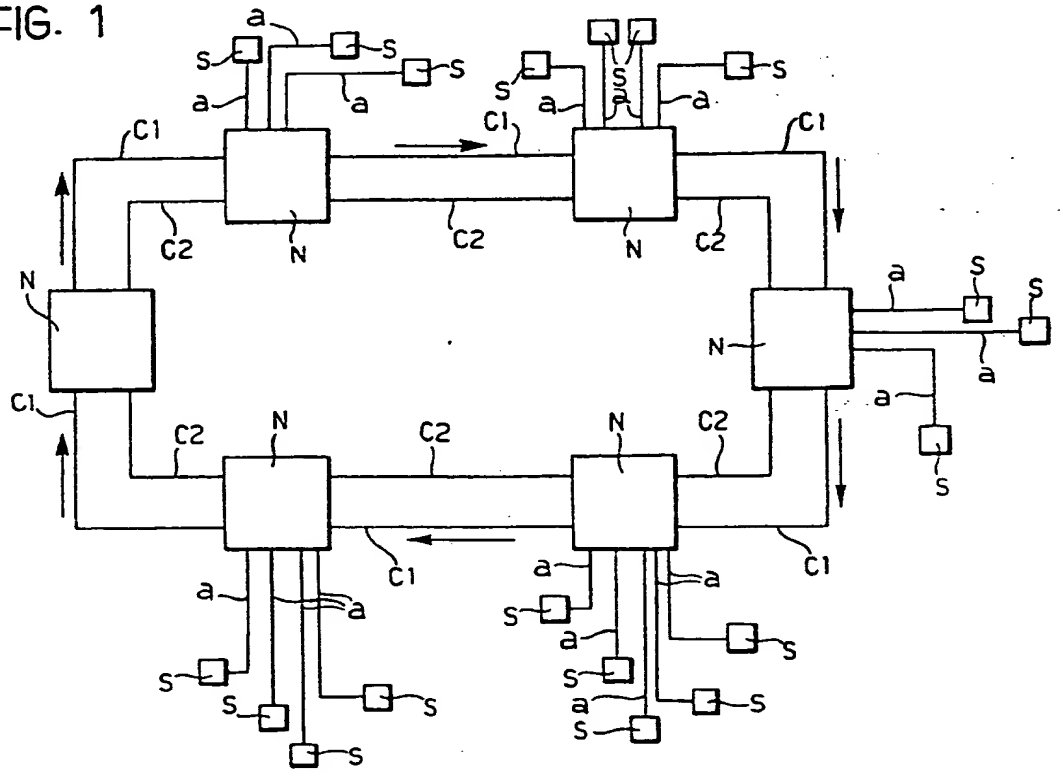
(54) Integrated data control and transmission system

(57) The system comprises a plurality of nodes (N) which are interconnected by pairs of main channels (c1, c2) so as to form a double-ring local communications network, e.g. of the "Token Ring" type. Respective peripheral subsystems (S) which can receive and/or transmit data or command signals in accordance with the same or different respective protocols or standards are connected to each node (N) by means of respective secondary channels (a). Each node is configured to either supervise the whole system or carry out software interpretation procedures between subsystems (S) and the network.

FIG. 1



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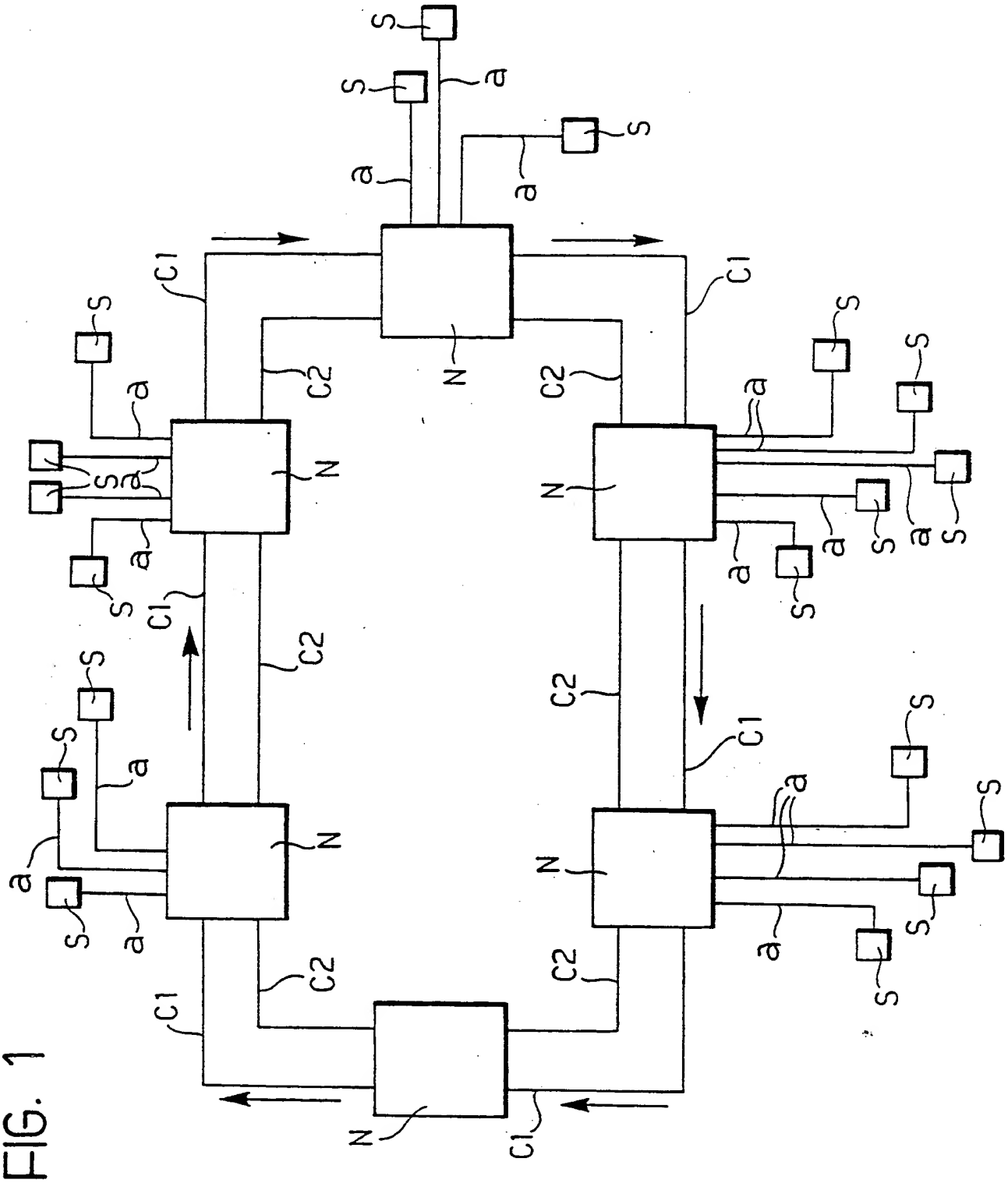


FIG. 1

FIG. 2

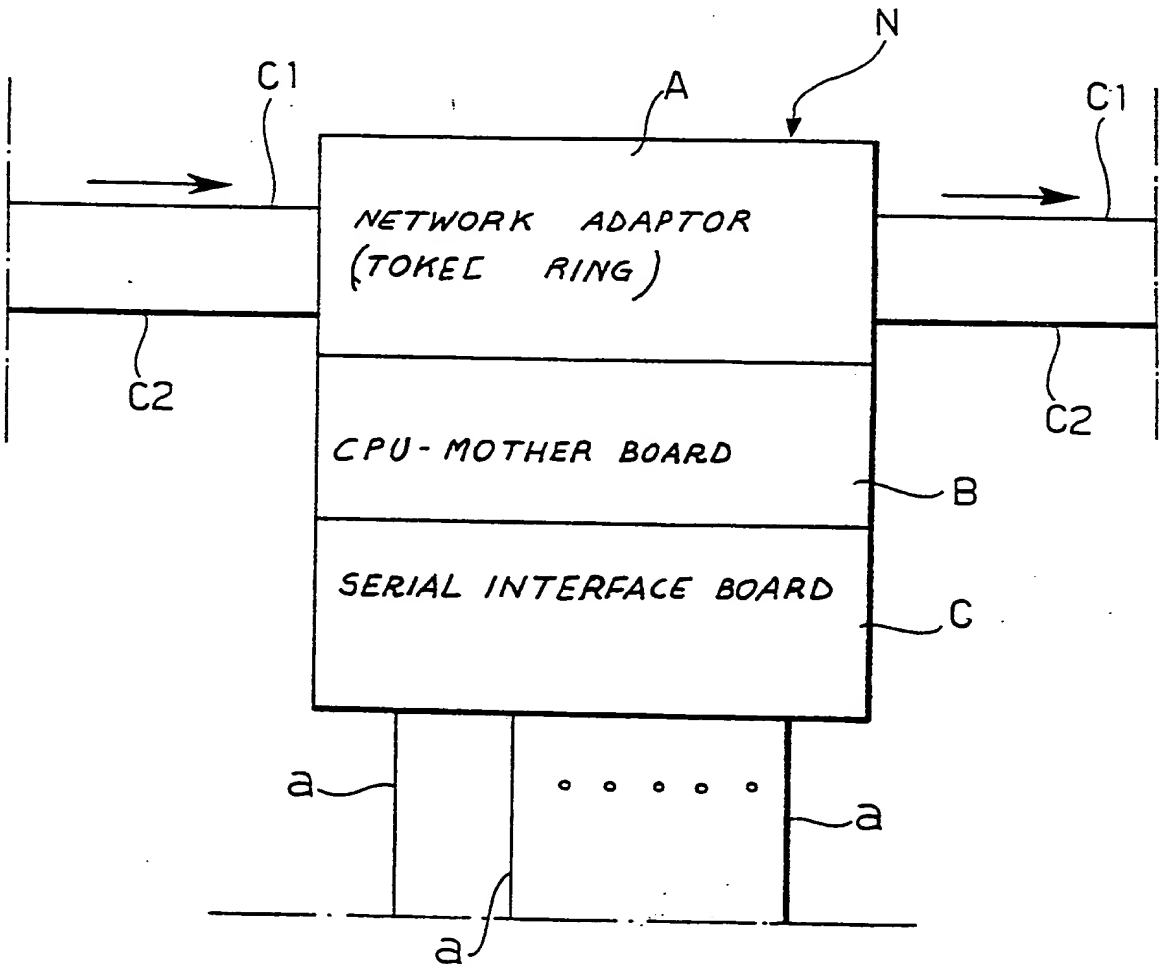

N
C1
A
C1
NETWORK ADAPTOR
(TOKEC RING)
C2
C2
CPU-MOTHER BOARD
B
SERIAL INTERFACE BOARD
C
a
a
a

FIG. 3

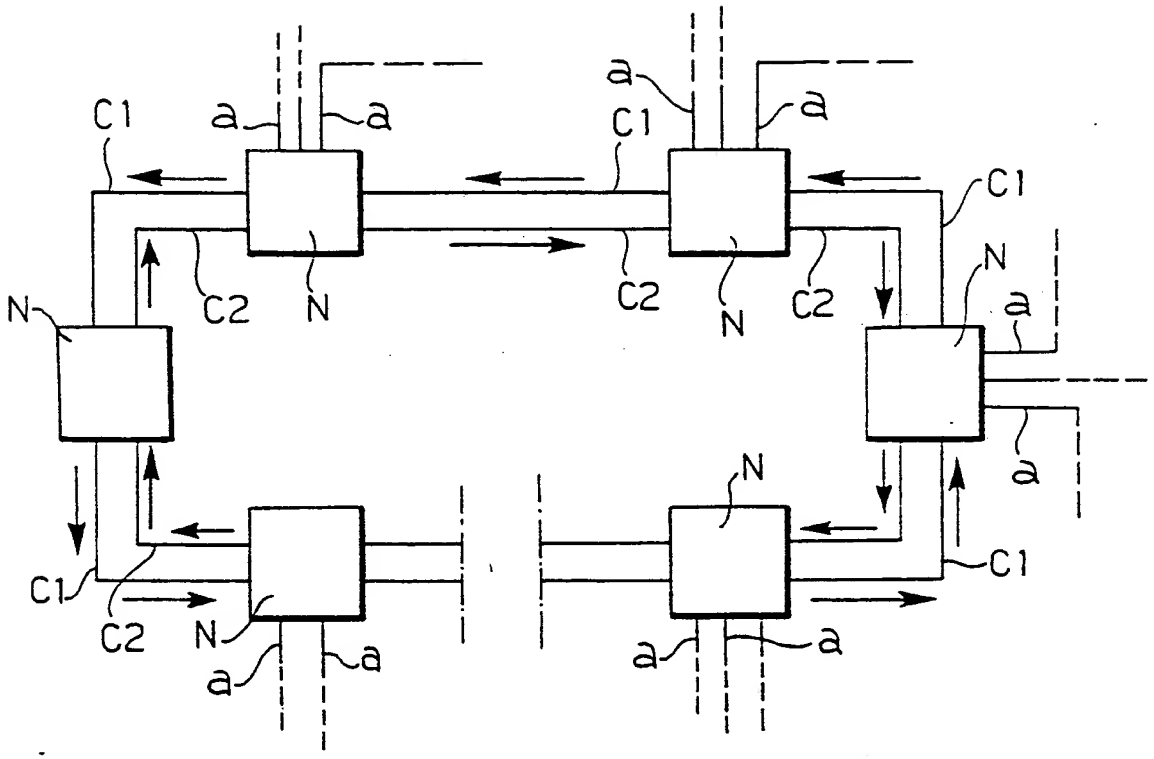
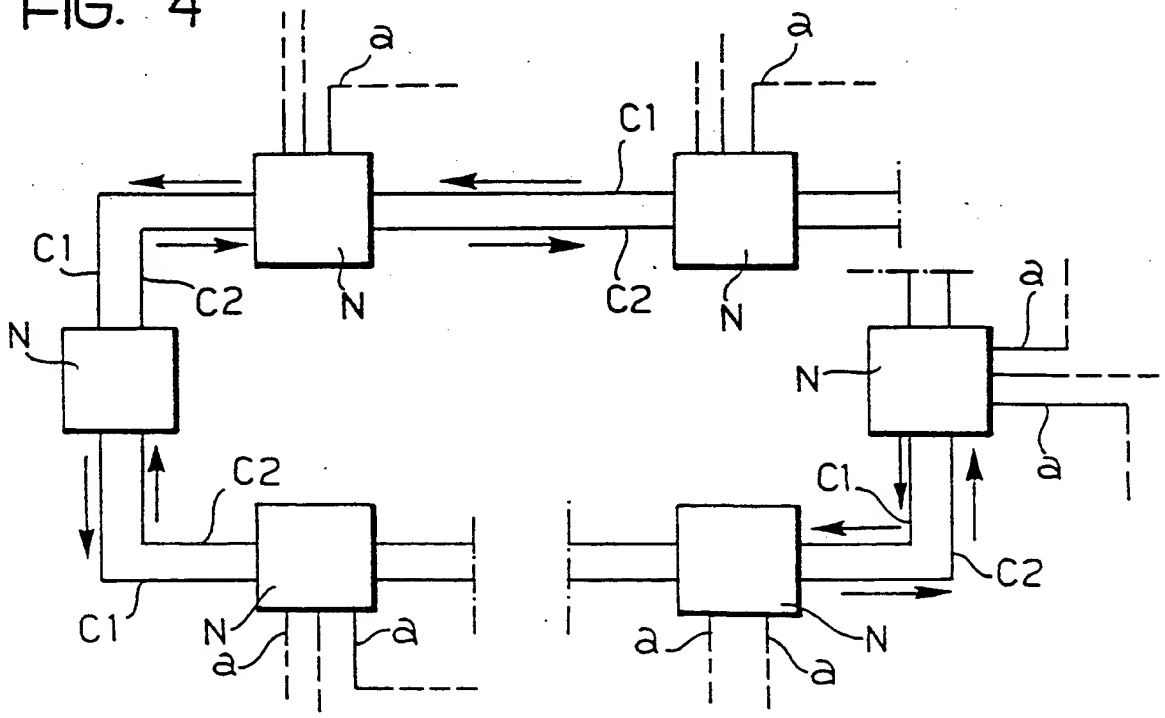

C1
a
a
C1
a
C1
N
C2
N
C2
N
C2
N
a
N
a
C1
C2
N
a
a
N
a
a
C1

FIG. 4


a
a
C1
C1
C2
N
C2
N
N
a
N
C2
C1
a
C1
N
a
a
C2
N
a
a

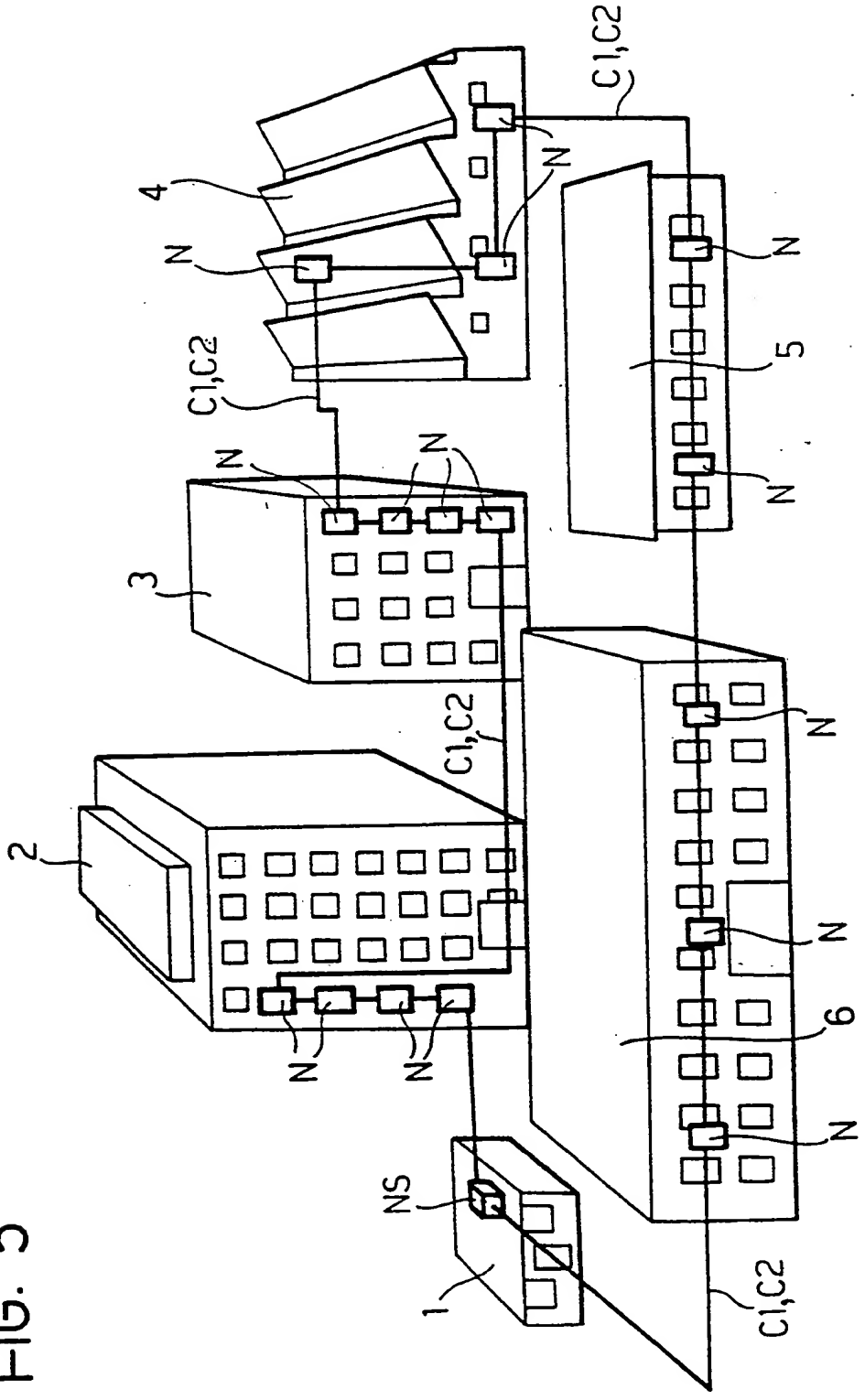


FIG. 5

DESCRIPTION

The present invention relates to an integrated data-control and -transmission system for the management of a plurality of peripheral subsystems.

The system according to the invention is characterized in that it comprises:

a plurality of nodes interconnected by means of pairs of unidirectional main channels so as to form a double-ring, unidirectional, local communications network, particularly of the Token Ring type,

a plurality of peripheral subsystems which can receive and/or transmit data or command signals in accordance with the same or different respective protocols or standards being connected or connectible to each node by means of respective secondary channels for connection to the node,

each node comprising:

a network adaptor, particularly a Token Ring network adaptor,

an interface, particularly a serial interface, for managing communications with the peripheral subsystems connected to the node, and

a microprocessor electronic processing unit with associated memory devices,

the electronic processing unit of at least one predetermined node being adapted to carry out

procedures for supervising the system and managing communications in the network,

the electronic processing units of the other nodes being adapted to carry out software interpretation procedures for translating the signals coming from the associated peripheral subsystems into messages which can be transmitted on the network and for translating messages coming from the network into data or control signals which can be transmitted selectively to the associated peripheral subsystems,

the electronic processing unit of each node being configured structurally in a manner such that it can equally well carry out the supervision procedures or the interpretation procedures.

Data-control and -transmission systems which enable the coordinated management of a plurality of peripheral subsystems have been developed for so-called "building automation" applications. These systems presuppose that the user uses peripheral subsystems of the same type, that is, they are arranged to receive and/or transmit data or control signals in accordance with the same protocol or standard. The integrated control systems proposed up to now by the various builders/suppliers are of the "proprietary" type and, in practice, the user therefore has to use peripheral subsystems which operate in accordance with the same standard. It is therefore not possible for the user to select alternative subsystems which are of the same type but which operate in accordance with different standards, neither is it possible to re-use subsystems which are already available but which operate according to different standards.

The data-control and -transmission system according to the invention, however, permits dialogue and integration between subsystems which differ as regards system types, brands, and communications protocols, and enables the user to select the subsystems, possibly re-using those already in his possession, releasing him from the need to acquire comprehensive solutions put together beforehand with "proprietary" matrices.

The system according to the invention has potential applications in many fields, for example, in integrated systems for security installations and for technological installations, and in building-automation systems in general.

The integrated systems for security installations which can be formed according to the invention can generally manage and control anti-intrusion, anti-burglary, anti-theft and surveillance functions (for example, by means of closed-circuit television). Further functions which can be managed by a system according to the invention are, for example, the detection and extinguishing of fires, the detection of gas leaks and of flooding, and the management of emergency situations and local evacuations.

The system according to the invention is also suitable for carrying out access-control functions, for example, by the management of electronic acquisition and control terminals, systems for controlling openings, and presence-detection systems.

Further functions which can be managed by a system of this type are those inherent in the management of subsystems for generating and/or supplying energy or

fluids (water, both for drinking and for industrial use, compressed air, etc.), as well as the management of industrial installations, handling and lifting equipment, depuration and ventilating equipment, etc.

According to need, a system according to the invention may be configured in a manner such that it can manage a plurality of peripheral subsystems belonging to the various types mentioned above.

Further functions which can be managed by a system according to the invention are those pertaining to communications (telephony, data- and image-transmission, etc.) as well as data-management and -distribution (office automation, electronic data-processing, etc.).

Further characteristics and advantages of the system according to the invention will become clear from the following detailed description, provided purely by way of non-limiting example, with reference to the appended drawings, in which:

Figure 1 is a block diagram of a system according to the invention, comprising six nodes,

Figure 2 is a block diagram which shows the structure of a node,

Figures 3 and 4 are diagrams showing the ways in which a system of the type shown in Figure 1 is reconfigured in the event of a single and of a double break in the communications network between the nodes, respectively, and

Figure 5 shows schematically an example of the application of the system according to the invention to the control of a plurality of peripheral subsystems located in a multiplicity of adjacent buildings.

Figure 1 shows a data-control and -transmission system for the management of a plurality of peripheral subsystems according to the invention. The system comprises a plurality of nodes N (6 in the embodiment illustrated) which are interconnected by means of pairs of unidirectional main channels c1 and c2, in a manner such that, as a whole, they form a unidirectional local communications network with a double-ring configuration, in particular, a Token Ring network.

One particular node of the network (the node furthest to the left in Figure 1) acts as the supervisor node; a respective plurality of peripheral subsystems, indicated S, which are generally (but not necessarily) of a heterogeneous nature, is connected (or connectable) to each of the other nodes.

Each peripheral subsystem S is intended to carry out a respective specific set of functions, for example, to detect conditions or states, or the magnitude of at least one physical quantity, or to carry out commands.

The peripheral subsystems S may comprise, for example, surveillance devices, fire detectors, devices for activating extinguishers, for controlling access, for controlling the generation and/or supply of energy or fluids, the switching on/off of technological equipment or installations, etc.

In general, the peripheral subsystems S can receive

data or control signals from the respective node and/or transmit data or control signals to the respective node in accordance with respective protocols or standards which may be the same or different, by means of respective secondary channels, indicated a, for connection to the node.

The main channels c1 and c2 may be formed by telephonic loops, by optical fibres, or even by coaxial cables.

In normal operation, the nodes N communicate with each other by means of one ring, for example, the ring formed by the channels c1, whilst the other ring (the back-up ring) remains inactive.

The secondary channels a are generally constituted by electrical cables.

Although, as stated above, at least one particular node of the network of a system according to the invention assumes the function of the supervisor node in operation and is arranged to carry out procedures for supervising the system and managing the communications on the double-ring network, the various nodes of the network are conveniently configured in a manner such that each of them can operate as a supervisor node if necessary.

Figure 2 shows in blocks the structure of a generic node N of the network. The node comprises, essentially, a network adaptor A, particularly a Token Ring adaptor, connected to the physical channels c1 and c2 for connection to the adjacent nodes. The node also comprises an electronic processing unit in the form of a mother board B comprising a CPU such as, for

example, an 80386 processor operating at 25 MHz with, for example, 1Mb of random access memory (RAM).

Each node for managing peripheral subsystems also comprises a serial interface board C which can manage a large number of secondary channels a (for example 16 channels) in accordance with a predetermined standard such as the RS232 standard or the 485 or 422 standards.

As regards the number of nodes which can be configured in the network, with the use of the Token Ring protocol, the system can be expanded up to a maximum of 255 nodes. The control system according to the invention can thus even be adapted to multidepartmental complexes distributed over large areas.

Each node N conveniently also comprises a silicon disk board for forming a rapid access memory area for storing the management software and the configurative parameters of the network. The use of a board of this type avoids the use of disk units which require considerable maintenance and are more susceptible to wear.

As regards the serial interface board of each node, it has a plurality of communications ports with interrupt control, with a maximum speed of 56 kbaud with a single channel and 9600 baud for each channel. This enables different priorities to be attributed to channels associated with the node by the assignment of different transmission speeds thereto.

The software installed in each node is conveniently written in Assembler and "C" language and advantageously refers to BIOS and NETBIOS interfaces,

ensuring complete independence from the MS-DOS operating system and a fast execution speed.

The processing unit of each node N is arranged so that it can carry out software interpretation procedures for translating the signals coming from the associated peripheral subsystems S into messages which can be transmitted on the double-ring network, with respective addressing codes, and for translating the messages circulating on the network into data and control signals which can be transmitted selectively to the associated peripheral subsystems.

By virtue of these software interpretation procedures, as stated above, the system permits dialogue and integration between peripheral systems which are heterogenous as regards their functions, types, brands or communications protocols.

The structure described above represents the minimal node structure. It can be developed further, according to need, by the insertion or addition, for example, of further image-acquisition and -digitizing boards, vocal synthesis boards, graphics boards for controlling monitors, disk or tape units for storage and for the historical recording of events which occur, or printing units, etc.

The ring architecture of the communications network used in the system makes attempts at fraudulent access to the system particularly difficult. The double-ring configuration of the network also has the advantage that the system can continue to operate even in the event of a cut or break in the connection between two nodes. In such an event, as shown in Figure 3, all

the nodes of the network nevertheless remain connected.

In the event of a multiple break in the ring network, for example, a double break, as shown in Figure 4, the system breaks up into a plurality of autonomous islands and, although there is inevitably a reduction in functionality, a complete shutdown of the system is avoided.

The system described above may be further enlarged by the installation of two Token Ring network adaptors in the same node, in which case, it is possible to form a system with a local network having a figure-8-shaped configuration with two rings joined together.

The circulation of the data in the ring network of the system takes place in accordance with the known Token Ring technique and is therefore based on the use of a token or sign which circulates in the ring. When a generic node N intends to transmit a message, it must wait for the token to pass and must then "occupy" it; the node changes the token from free to occupied and thus transmits the message.

When there are no free tokens in the ring network, the nodes which wish to transmit messages remain waiting. The message in the network travels around the whole ring and is "cleared" by the node which generated it.

As is known, the "Token Ring" protocol generally has shorter average transmission delays than the CSMA/CD protocol and this is all the more true as the number of nodes increases.

Figure 5 shows schematically the application of the

system described above to the control and management of a plurality of peripheral subsystems distributed in a plurality of buildings indicated 1 to 6. The supervisor node, indicated NS, is located in a first building 1 and the nodes N to which the peripheral subsystems (not shown) are connected are located in the other buildings 2 to 6, possibly on different floors of the same building, as is the case shown in the buildings 2 and 3.

The data-control and -transmission system according to the invention has many advantages.

First of all, the system is efficient, simple, flexible and reliable. In fact it enables peripheral subsystems which differ in nature, brand and protocol to be managed in a unitary manner, integrating their operation and thus generating efficiency for the user.

From a structural point of view, the system has considerable simplicity, since it requires little wiring and the entire system and all the peripheral subsystems can even be managed by a single supervision node. The system can also operate without a supervision system. The design, installation and management of a system of this type are therefore very easy.

The flexibility of the system is clear; the system can be developed in an evolutionary manner over a period of time and can be reconfigured at any time.

The system is also economically advantageous since it is characterized by low installation and maintenance costs. It also reduces the number of employees

required for management and supervision and eliminates redundancy of common parts in the subsystems. It therefore requires a lower initial investment and has low running costs.

A further advantage of the system is represented by its multimedia capabilities: it can transmit data as well as telephonic and image signals and thus offers a vast range of means for effecting complete, effective and thorough control for the automation of buildings.

Naturally, the principle of the invention remaining the same, the forms of embodiment and details of construction may be varied widely with respect to those described and illustrated purely by way of non-limiting example, without thereby departing from the scope of the present invention.

CLAIMS

1. An integrated data-control and -transmission system for the management of a plurality of peripheral subsystems (S), comprising:

a plurality of nodes (N) interconnected by means of pairs of unidirectional main channels (c1, c2) so as to form a double-ring, unidirectional, local communications network, particularly of the Token Ring type,

a plurality of peripheral subsystems (S) which can receive and/or transmit data or control signals in accordance with the same or different respective protocols or standards being connected or connectible to each node (N) by means of respective secondary channels (a) for connection to the node (N),

each node (N) comprising:

a network adaptor (A), particularly a Token Ring network adaptor,

an interface (C), particularly a serial interface, for managing communications with the peripheral subsystems (S) connected to the node (N), and

a microprocessor electronic processing unit (B) with associated memory devices,

the electronic processing unit (B) of at least one predetermined node (N; NS) being adapted to carry out procedures for supervising the system and managing communications in the network,

the electronic processing units (B) of the other nodes (N) being adapted to carry out software interpretation procedures for translating the signals coming from the associated peripheral subsystems (S) into messages which can be transmitted on the network and for translating messages coming from the network into data or control signals which can be transmitted selectively to the associated peripheral subsystems (S),

the electronic processing unit of each node (N; NS) being configured structurally in a manner such that it can equally well carry out the supervision procedures or the interpretation procedures.

2. An integrated system according to Claim 1, characterized in that the main channels (c1, c2) are formed by telephonic loops, optical fibres, or coaxial cables.

3. An integrated system according to Claim 1 or Claim 2, characterized in that the secondary channels (a) are constituted by electrical cables.

4. An integrated system according to any one of the preceding claims, characterized in that the nodes (N) of the network are structured and arranged in a manner such that, in the event of a single break in the connection between two adjacent nodes (N), they can operate in a single-ring network (Figure 3).

5. An integrated system according to any one of the preceding claims, characterized in that the nodes (N) of the network are structured and arranged in a manner such that, in the event of a multiple break in the connections between nodes (N), they can operate in a

plurality of single-ring subnetworks (Figure 4).

6. An integrated data-control and transmission system for the management of a plurality of peripheral subsystems substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number
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Relevant Technical fields

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(ii) Int Cl (Edition 5) H04L 12/42

Search Examiner
K WILLIAMS

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search
29 SEPTEMBER 1993

Documents considered relevant following a search in respect of claims 1-5

Category (see over)	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2114858 A	(RACAL-MILGO) - see page 2 lines 7-12; page 5, lines 69-71	1-4
X	EP 0280231 A2	(HITACHI) - see column 8, lines 36-54	1,2,4
X	EP 0168258 A2	(FUJITSU) - see abstract and Figure 7A	1,2,4
A	EP 0152013 A2	(FMC CORP) - see abstract and Figure 9	1,2,4

Category	Identity of document and relevant passages	Relevant to claim(s)

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